

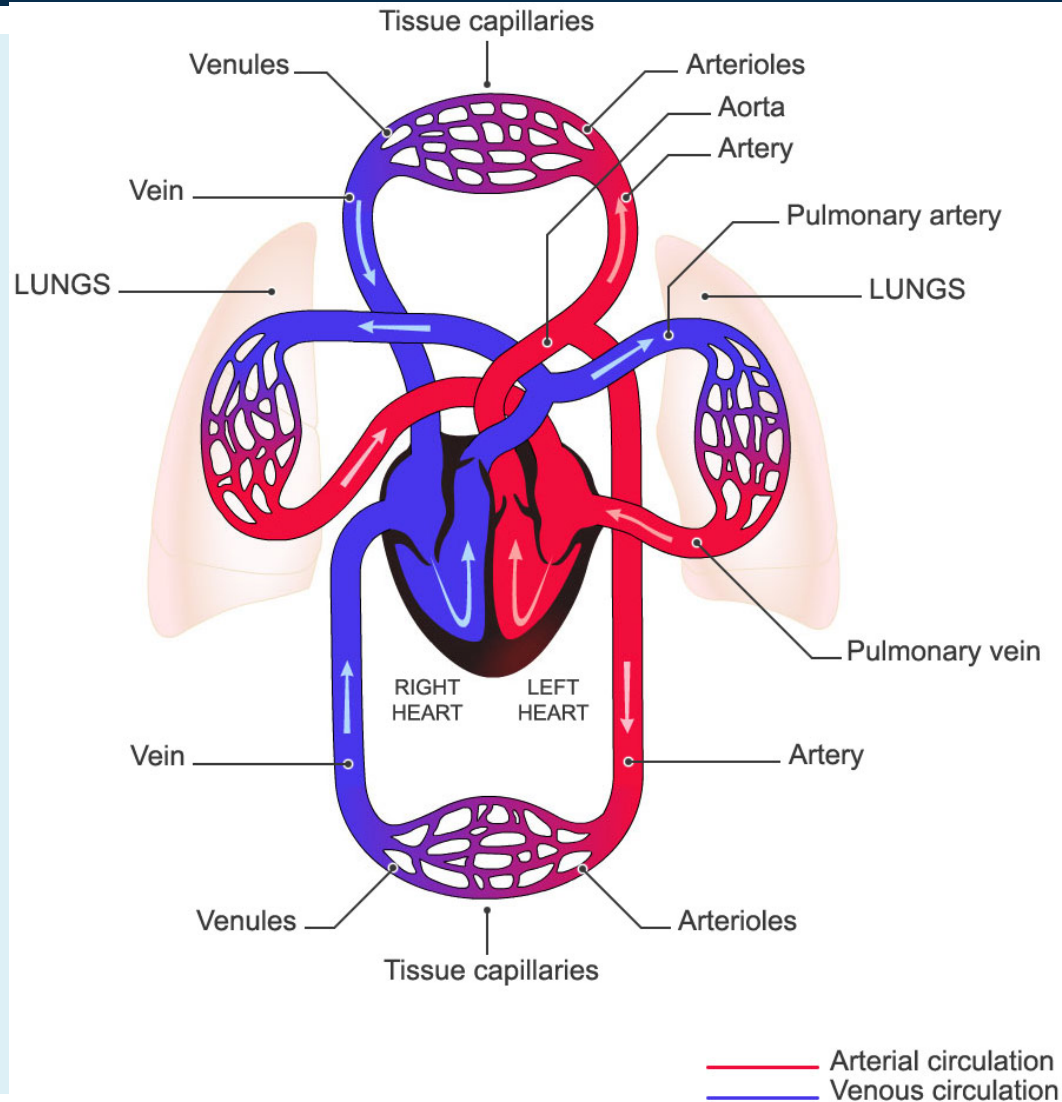
TRANSPORT IN HUMANS

Chapter 9

CIRCULATORY SYSTEM

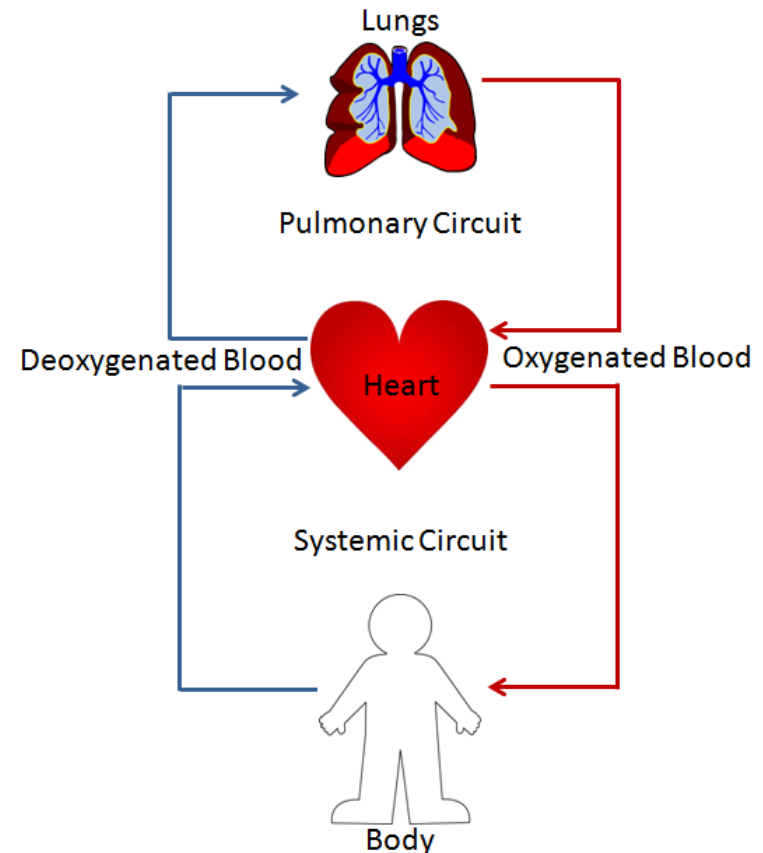
- components: blood, heart, and blood vessels
- Transports:
 - Oxygen, hormones, antibodies, blood protein
 - Digested food from small intestine to cells
 - Removes waste chemicals like carbon dioxide
- Heart → is the pump that circulates the blood through the blood vessels (one-way flow)

CIRCULATORY SYSTEM

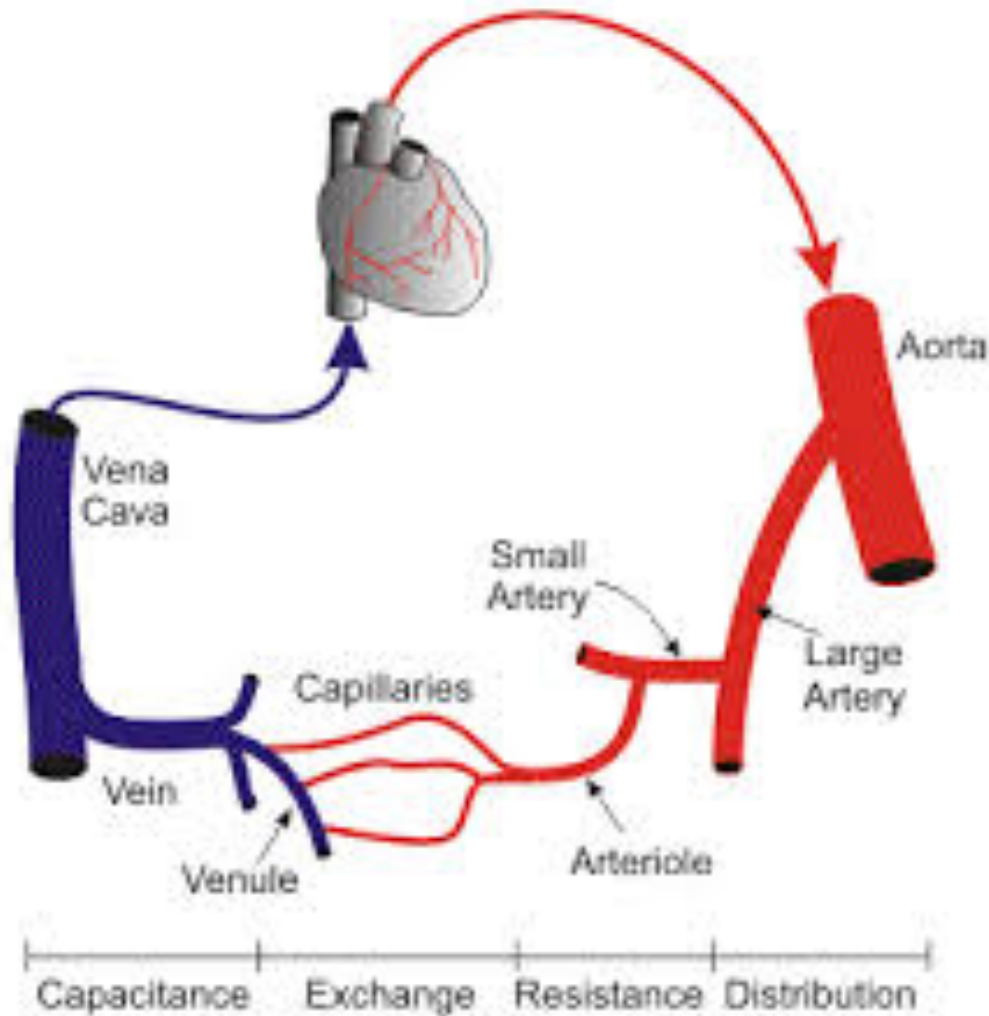


CIRCULATORY SYSTEM

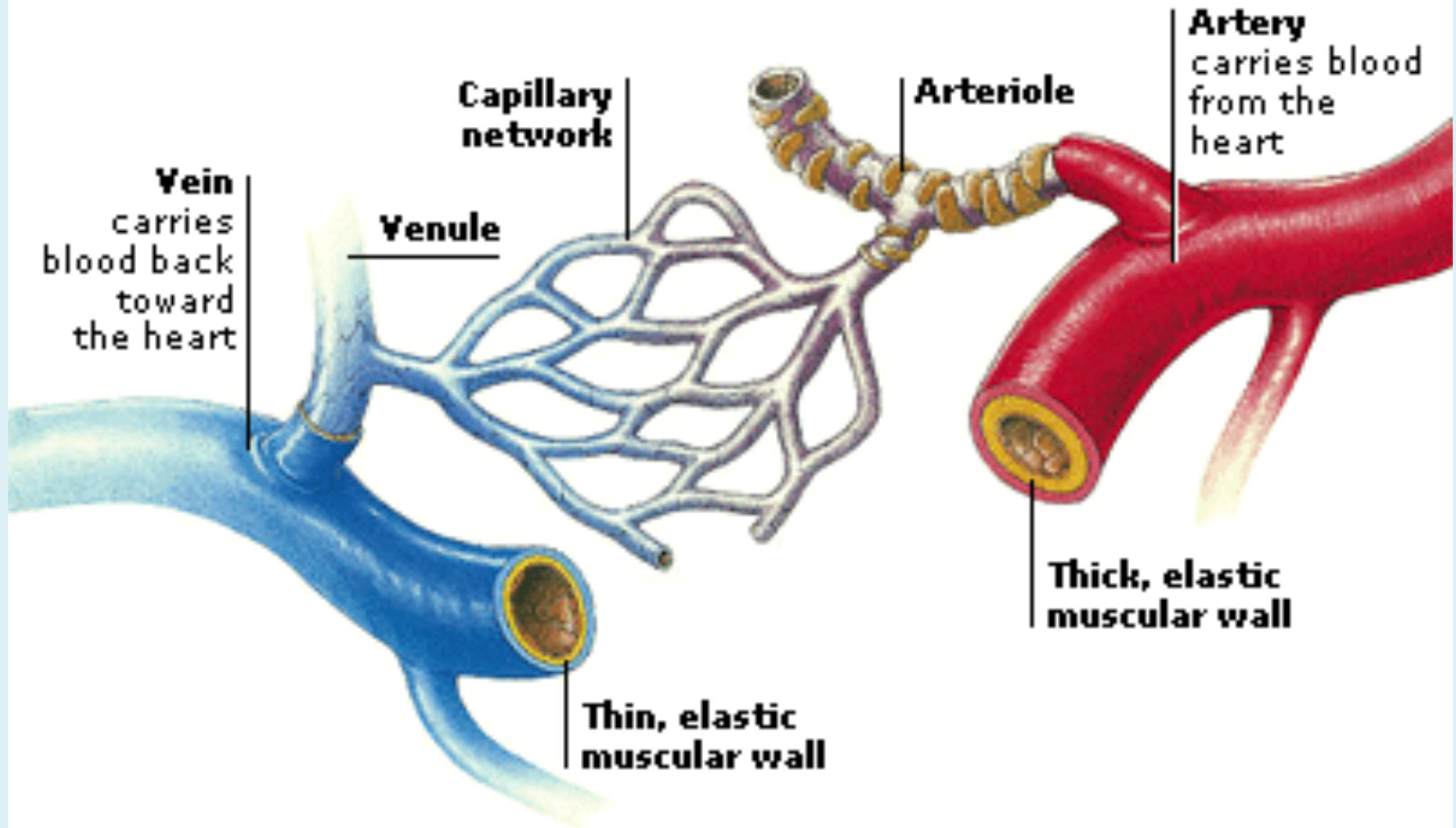
- It is a double circulatory system.
- It comprises two separate circuits and blood passes through the heart twice.
- **pulmonary circuit:**
 - carries blood to lungs to be **oxygenated** and then back to the heart.
 - In the lungs, carbon dioxide is removed from the blood
 - oxygen taken up by the haemoglobin in the red blood cells.
- **systemic circuit:**
 - carries blood around the body to deliver the oxygen
 - returns **de-oxygenated** blood to the heart.
 - Blood also carries nutrients and waste.



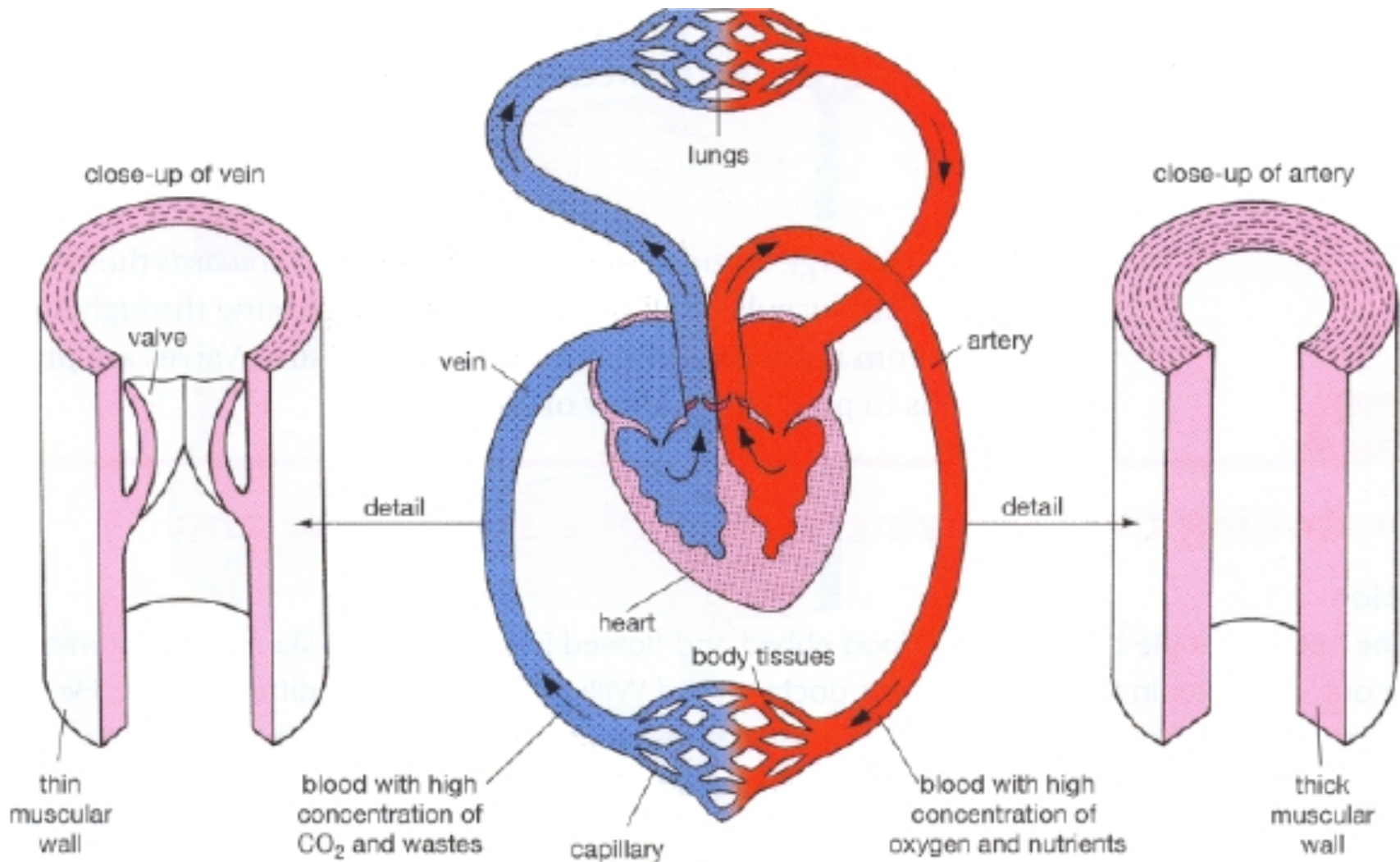
BLOOD VESSELS



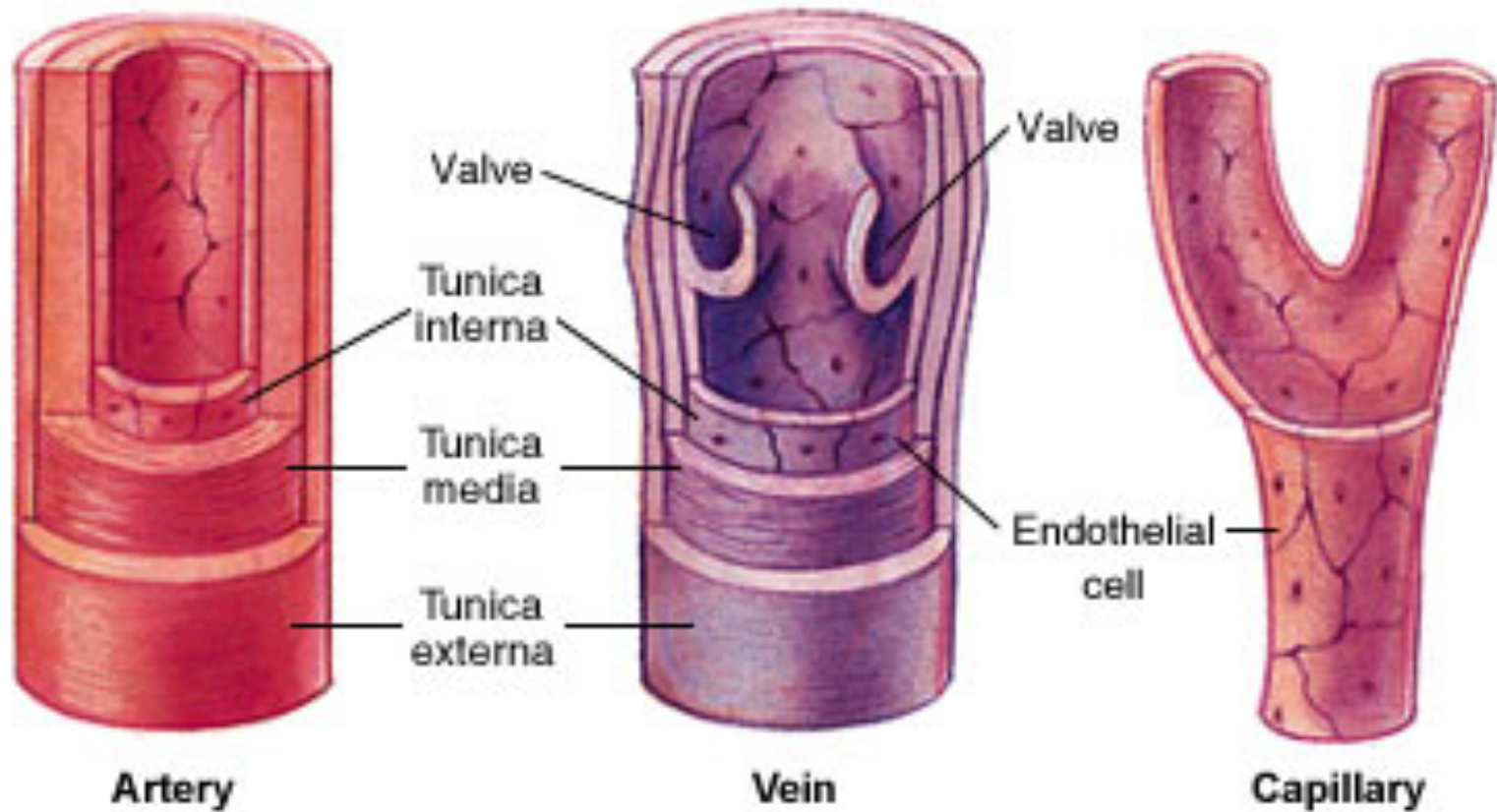
BLOOD VESSELS



BLOOD VESSELS



BLOOD VESSELS



BLOOD VESSELS

■ Arteries:

- Take away blood from heart to other organs
- High pressure
- Thick layer of muscle and elastic fibre to push blood
- Split to make capillaries (reduces pressure first through arterioles)

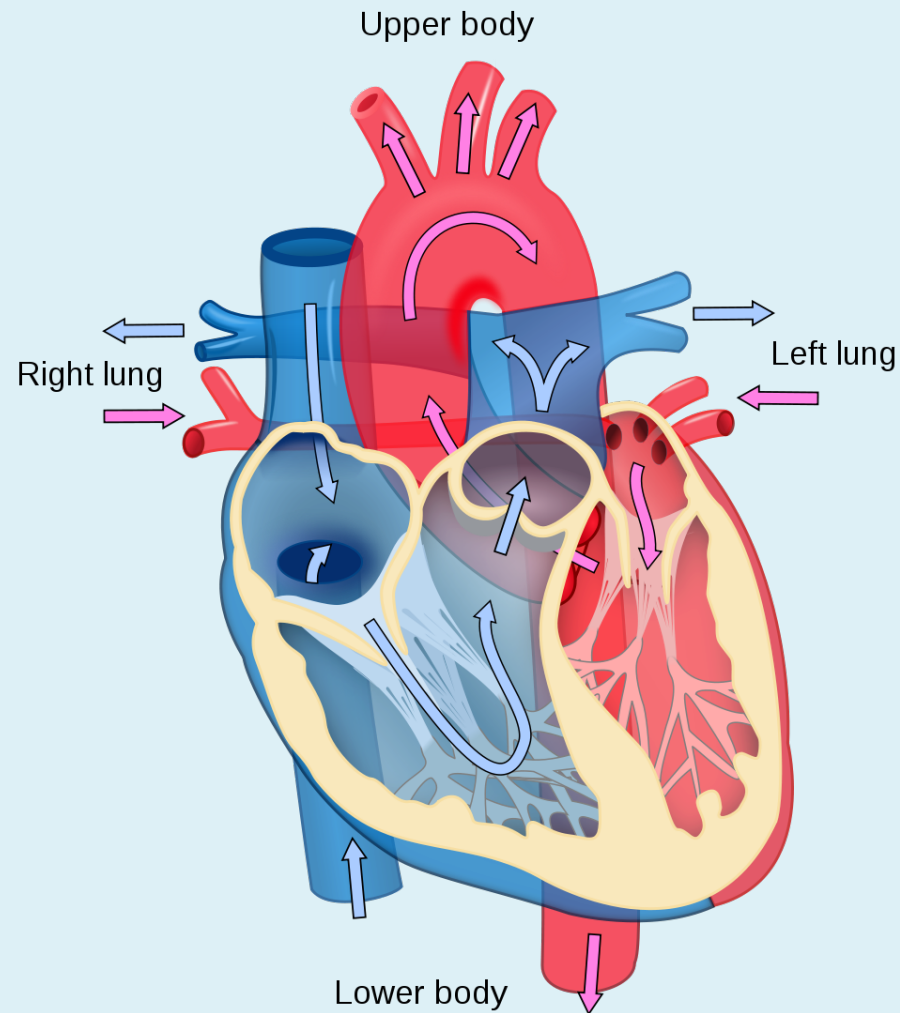
■ Veins:

- Made from capillaries joining together
- Less muscle and wider space for blood to flow
- Take blood from capillaries back to the heart
- Low pressure
- Have valves to stop blood from flowing backward

■ Capillaries:

- Smallest blood vessels that connect arteries to veins (80,000 km!!)
- Connects arteries and veins
- Goes to cells in body
- Large surface area to allow gas exchange with cells
- Very narrow (one blood cell at a time)

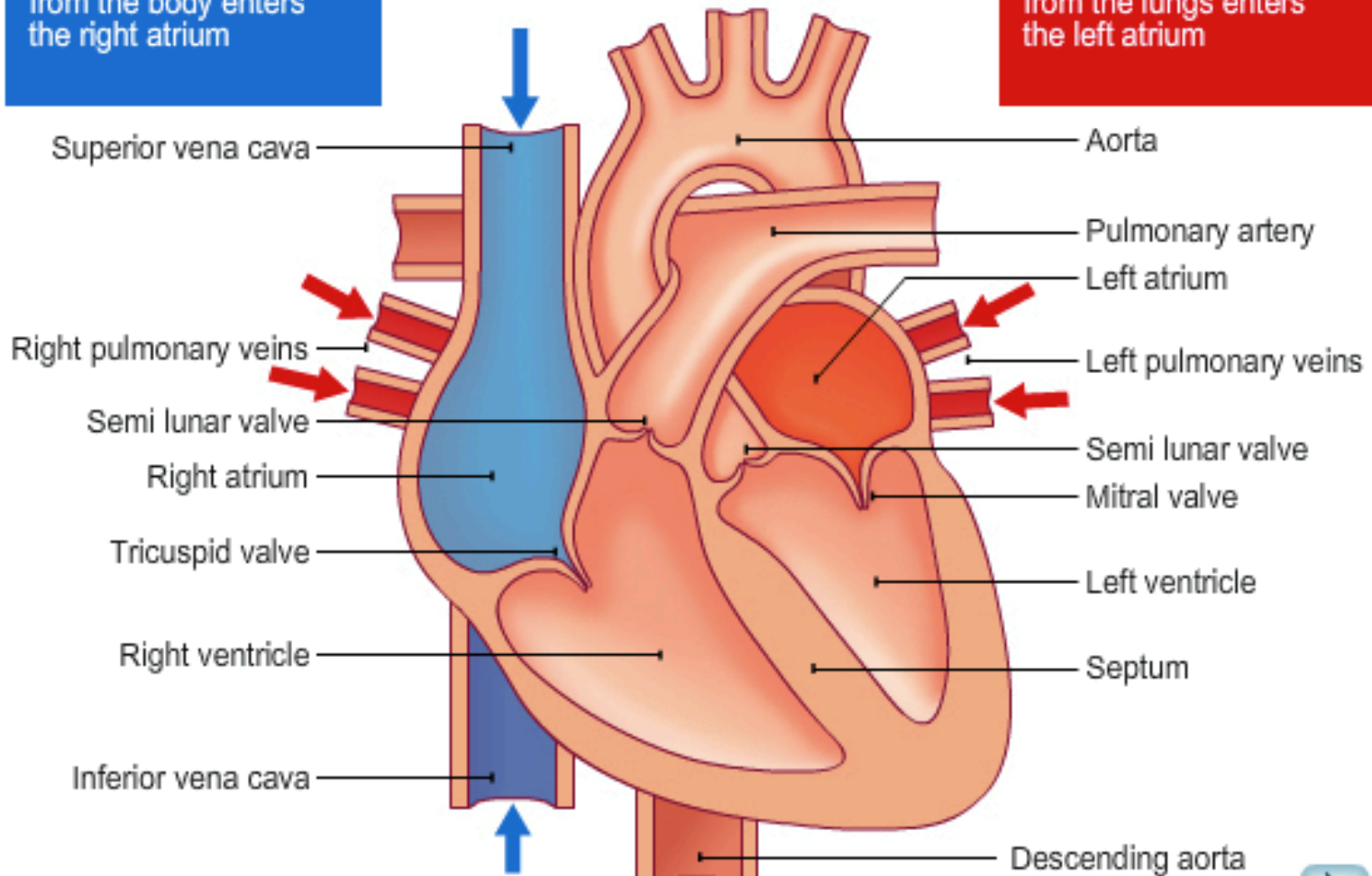
HEART



HEART

Deoxygenated blood from the body enters the right atrium

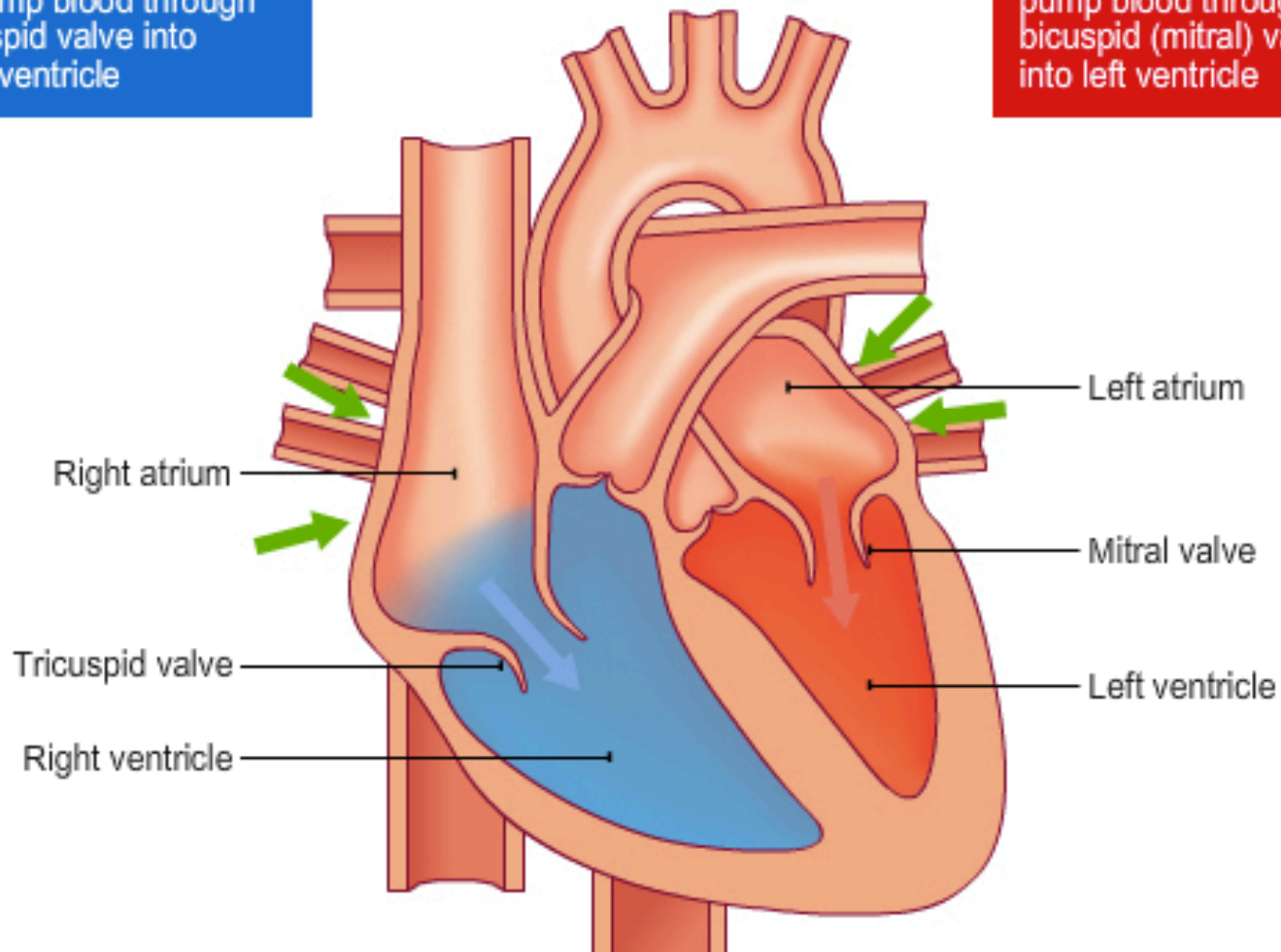
Oxygenated blood from the lungs enters the left atrium



HEART

Right atrium contracts to pump blood through tricuspid valve into right ventricle

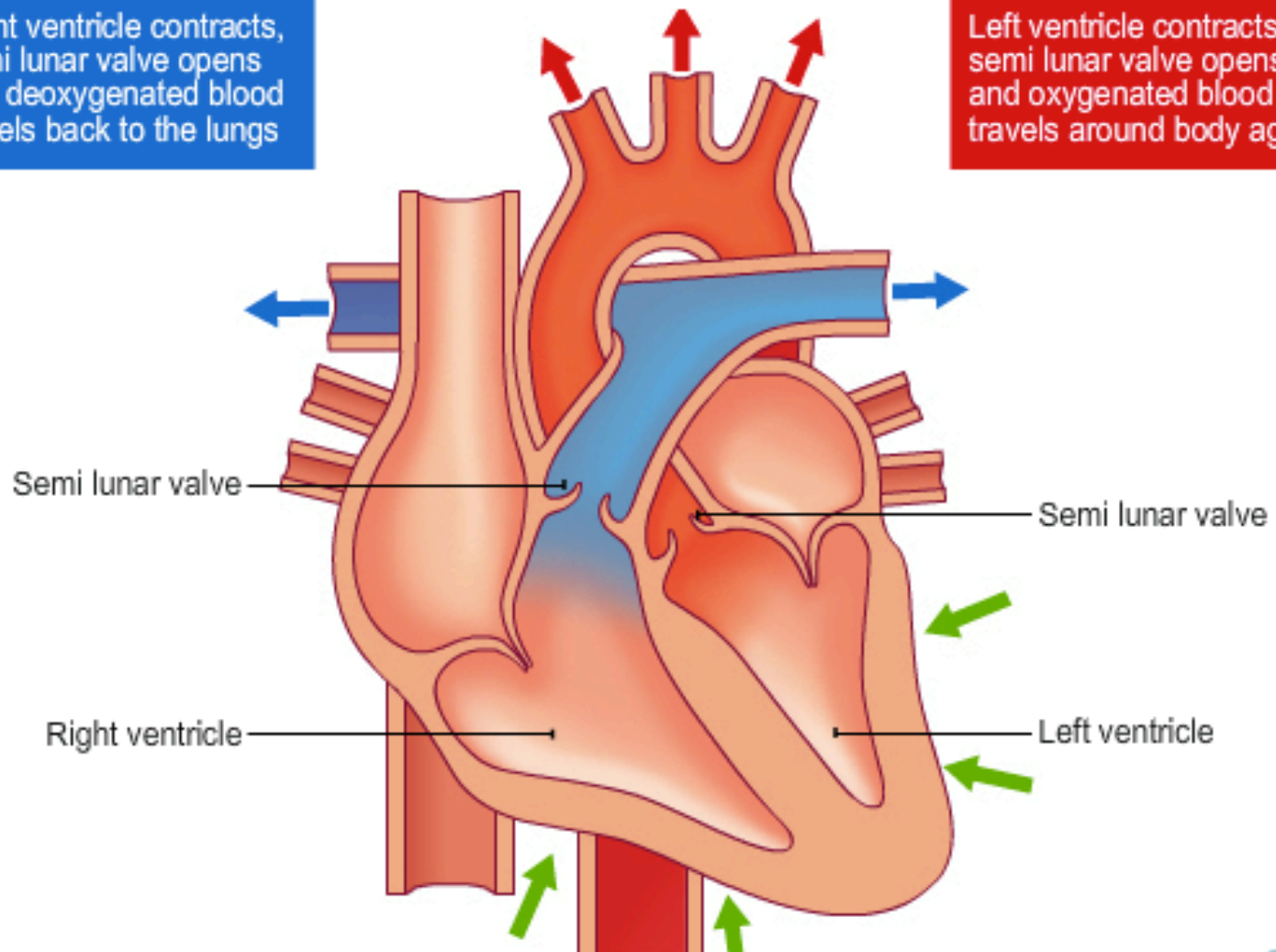
Left atrium contracts to pump blood through bicuspid (mitral) valve into left ventricle



HEART

Right ventricle contracts, semi lunar valve opens and deoxygenated blood travels back to the lungs

Left ventricle contracts, semi lunar valve opens and oxygenated blood travels around body again



HEART

- The heart has four chambers.
 - The two atria (singular: atrium) collect the blood.
 - The two ventricles pump the blood out of the heart.
- Valves prevent the blood from flowing backwards.
- The septum separates the two sides of the heart.
- The right side of the heart pumps **de-oxygenated** blood (blood not containing oxygen) to the lungs to pick up oxygen.
- The left side of the heart pumps the **oxygenated** blood from the lungs around the rest of the body.

HEART

- **Number the steps correctly:**

- The deoxygenated blood is carried back towards the heart in the veins. These join up to form the **vena cava** which is the largest vein.
- The right ventricle pumps the blood along the pulmonary artery to the lungs where it picks up fresh oxygen. It is now **oxygenated**.
- Blood returns from the body to the **right atrium**. The blood has lost most of the oxygen it carries and is now **deoxygenated**.
- The **oxygenated** blood enters the left side of the heart from the pulmonary vein and is pumped out through the **aorta** to the body.
- Once it reaches the capillaries around the body, oxygen **diffuses** out to the surrounding cells.

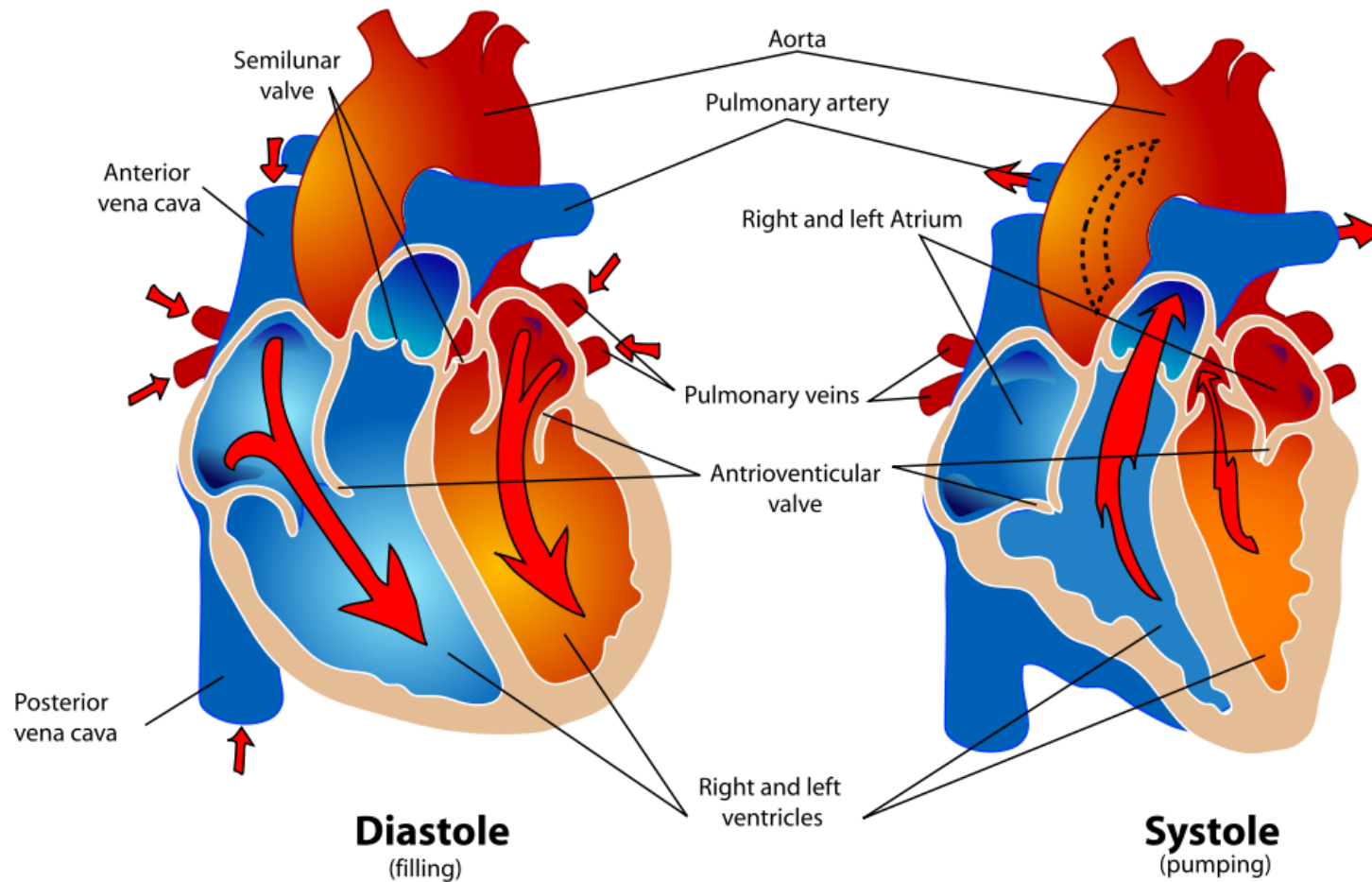
HEART

- True or false
 - veins only carry deoxygenated blood

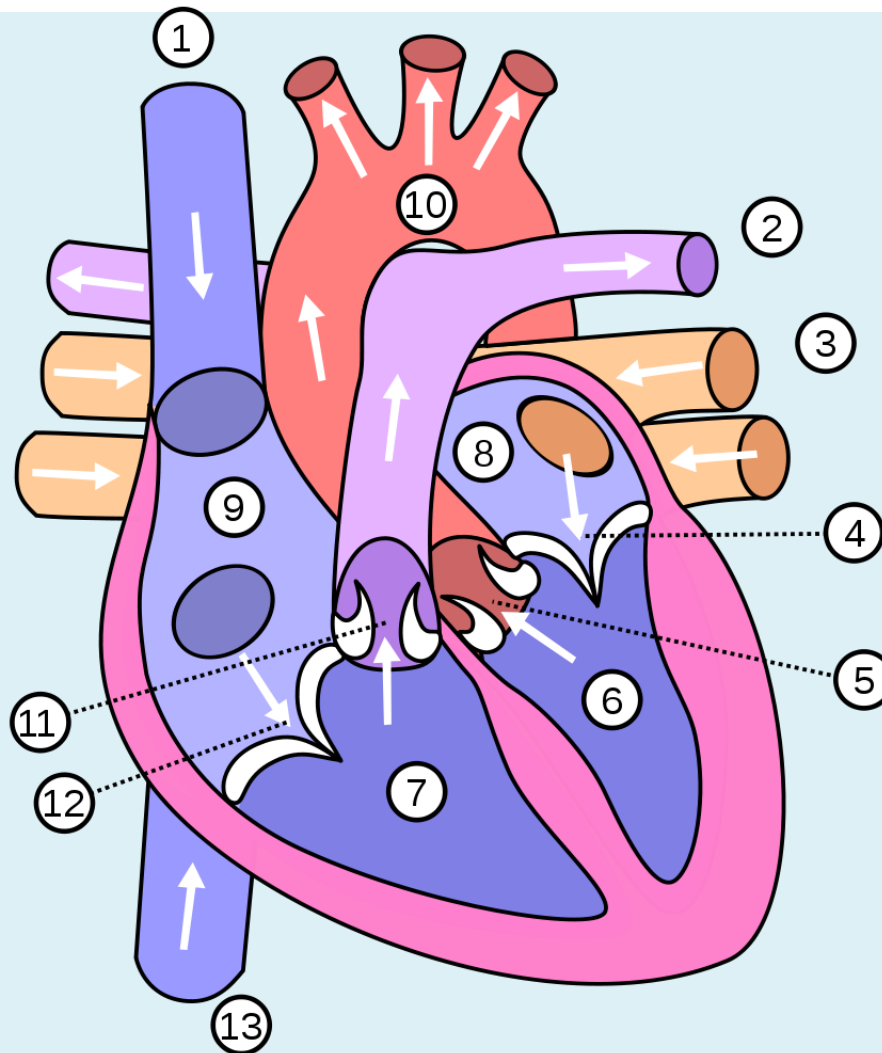
HEART

- The two sides of the heart work together
- Diastole: heart muscle relax – blood flows into atria
- Systole: heart muscles contract
 - Atria contract – force blood to go to ventricle – valves open from high pressure
 - Ventricles contract – force blood into arteries – valves will close to not allow blood to come back in

HEART



LABEL THE HEART



CORONARY HEART DISEASE

- Heart needs glucose and oxygen (transported through arteries) to keep it contracting
- When arteries blocked → muscle starved from oxygen → die → causes a heart attack
- Atherosclerosis: cholesterol stick to artery sides slowing blood flow
- Thrombosis: blockage of blood vessel

CORONARY HEART DISEASE



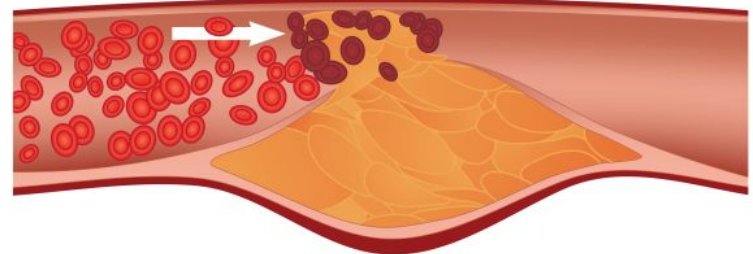
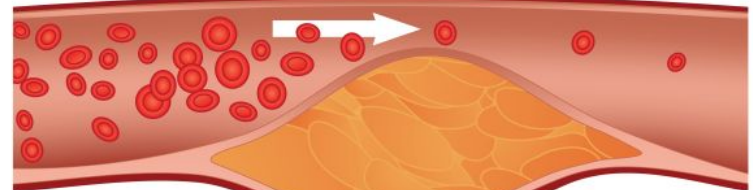
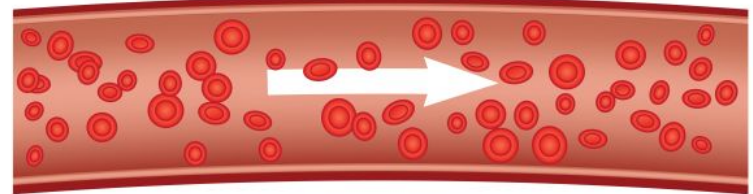
Normal coronary artery



Atherosclerosis



Atherosclerosis with blood clot

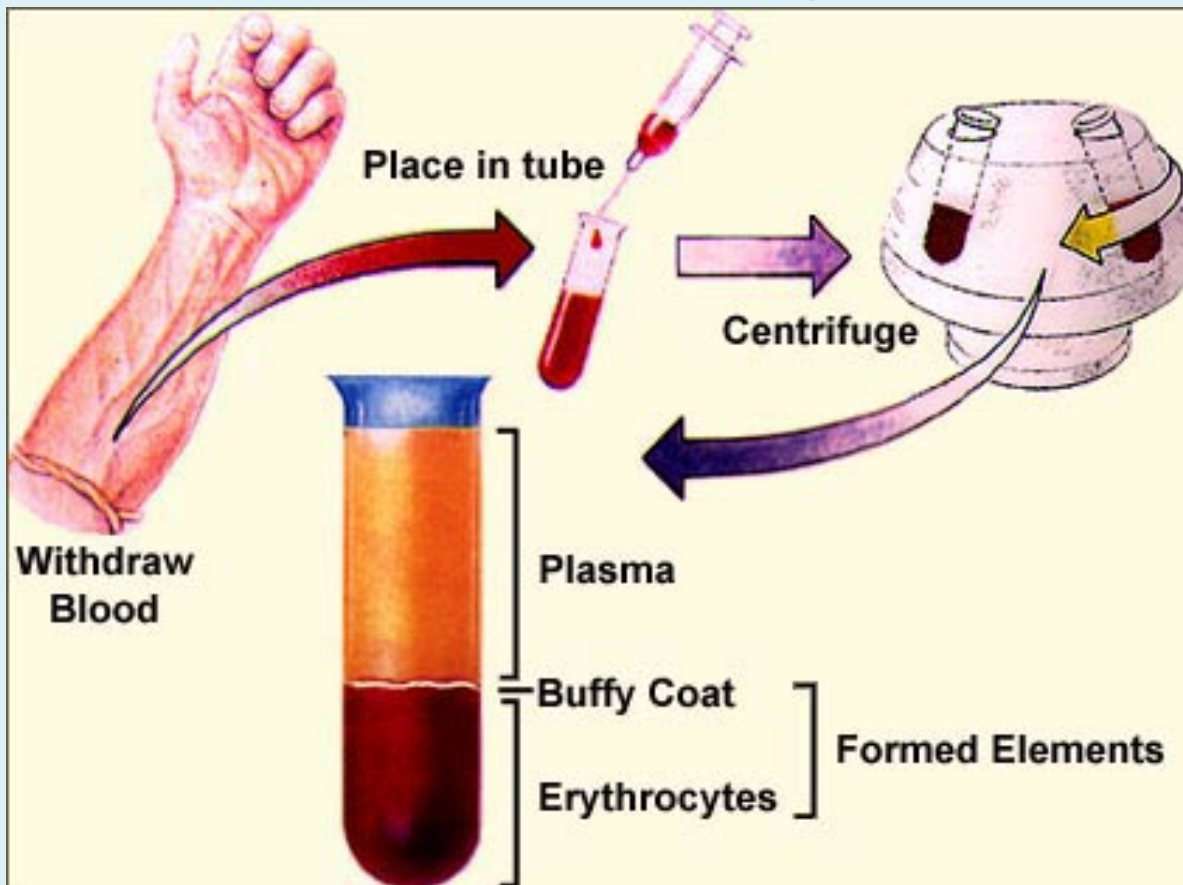


CORONARY HEART DISEASE

- Partial blockage → chest pain (angina)
- Complete blockage → heart attack (heart not getting oxygen → severe pain → cardiac arrest)
- Factors that increase CHD:
 - Lots of saturated fat
 - Over-weight
 - Smoking
 - Little/no exercise
 - Genes
 - Age
 - sex

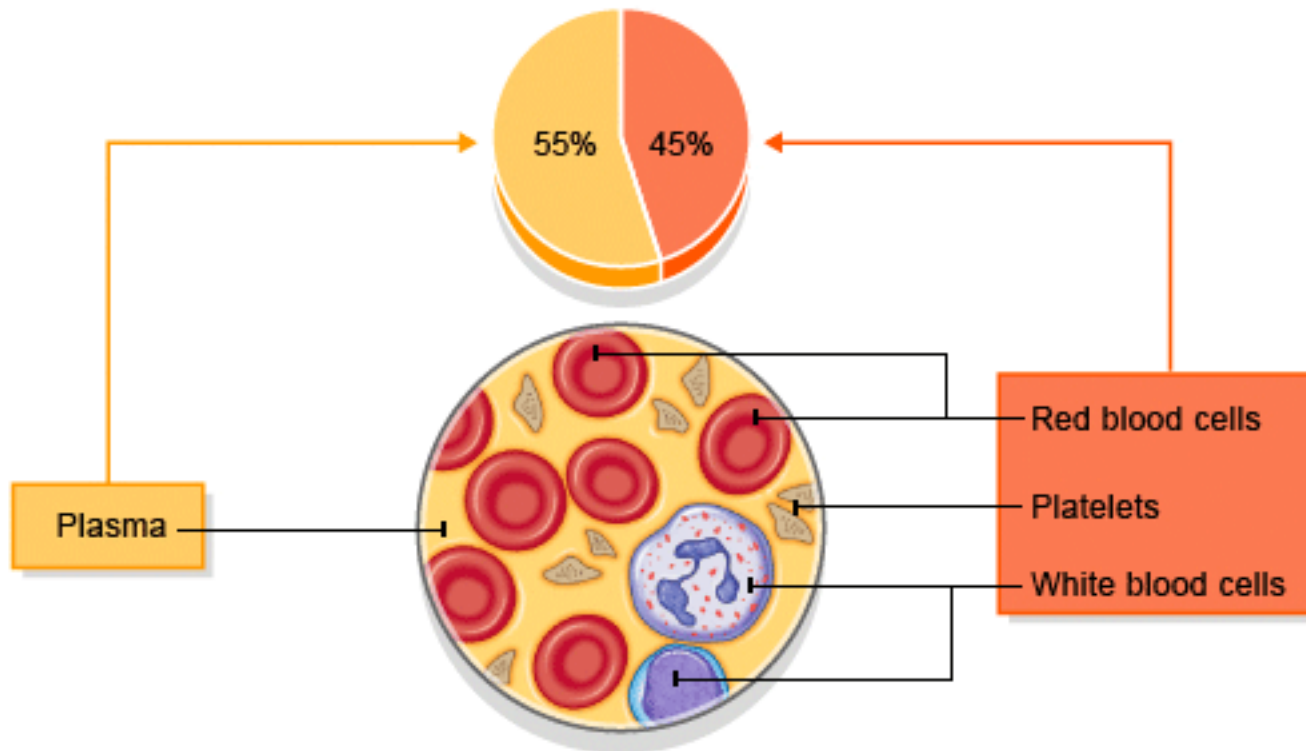
BLOOD COMPOSITION

- Body has 5 litres of blood
- Blood made from cells and cell fragments



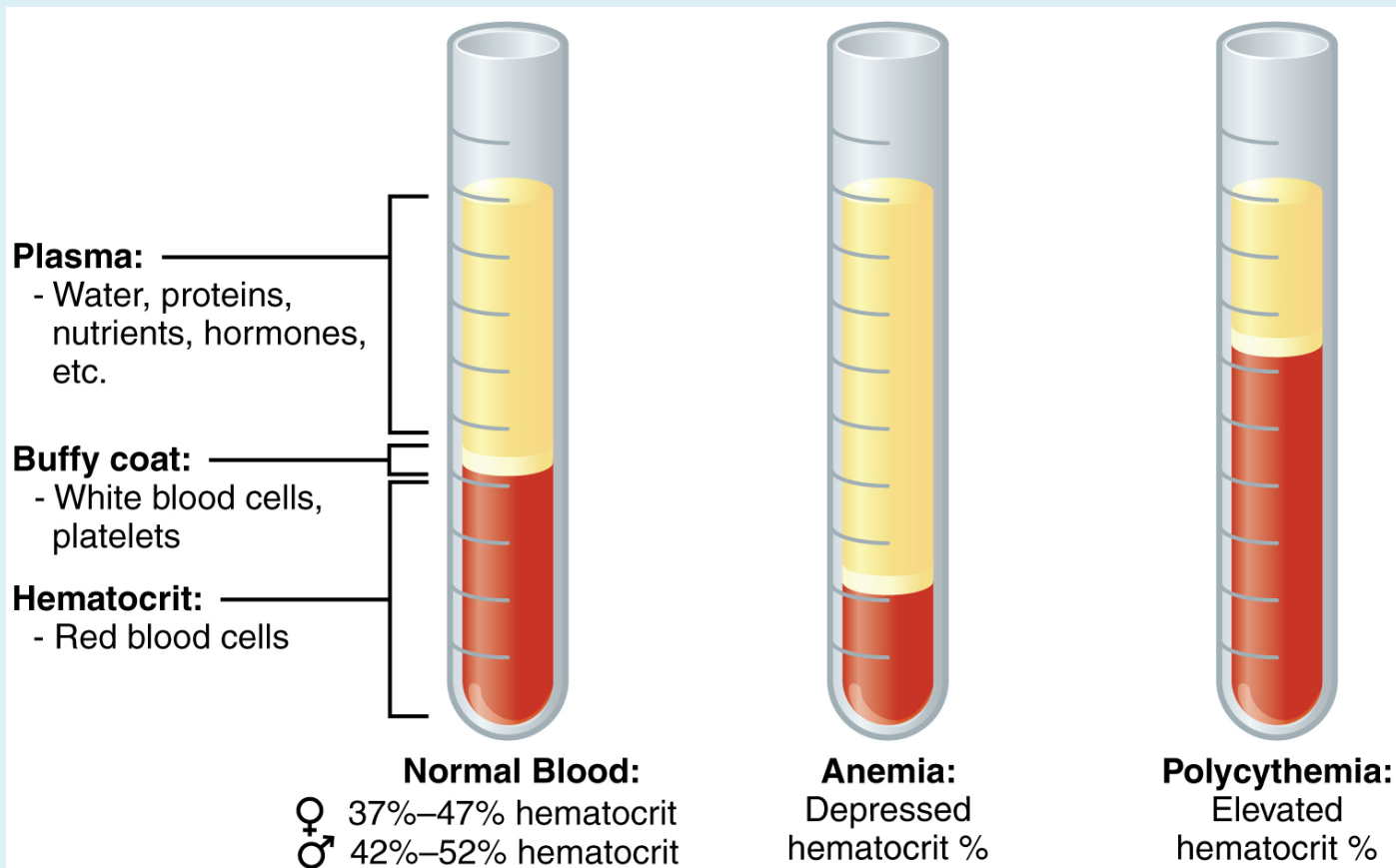
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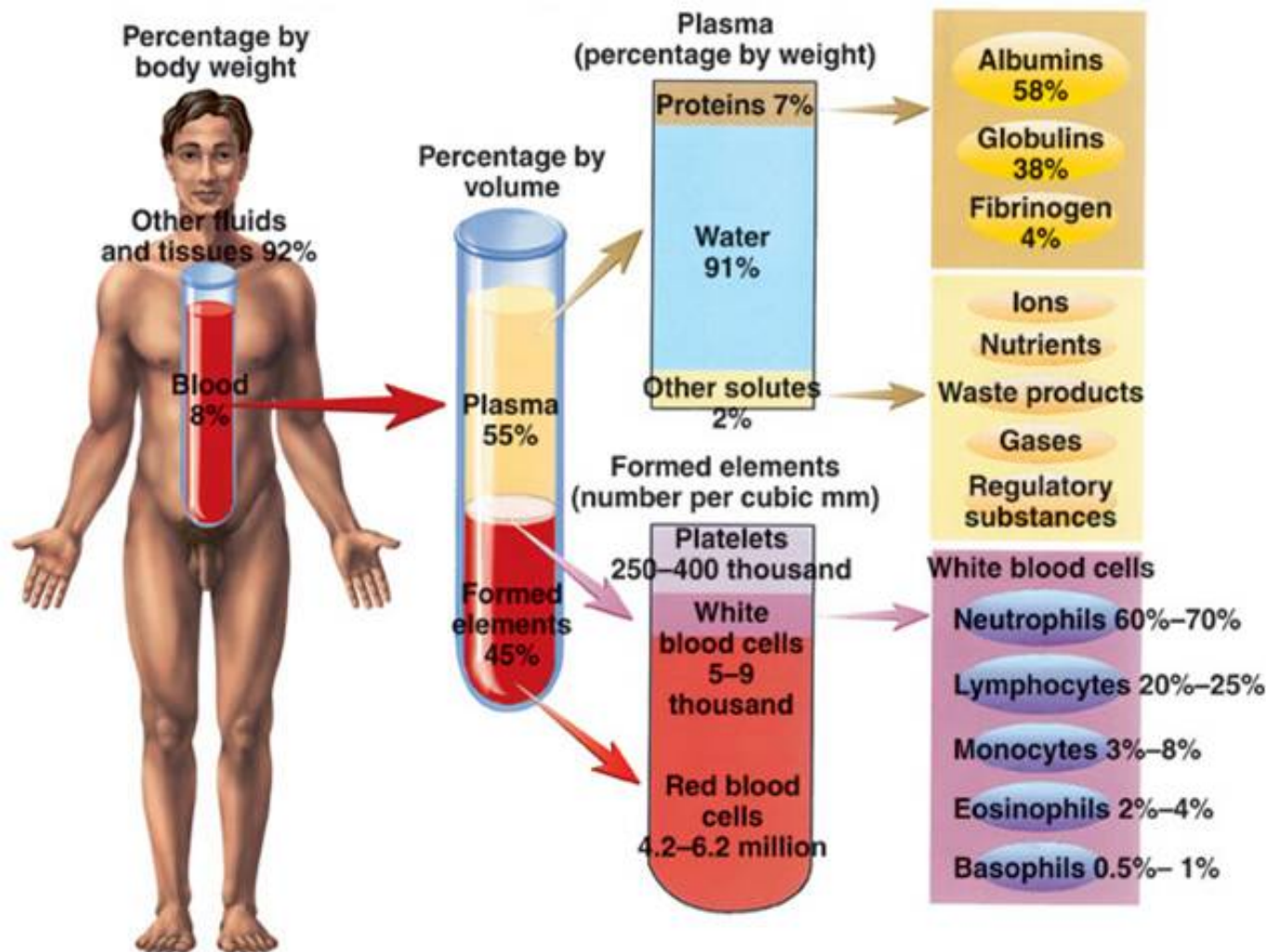


BLOOD COMPOSITION

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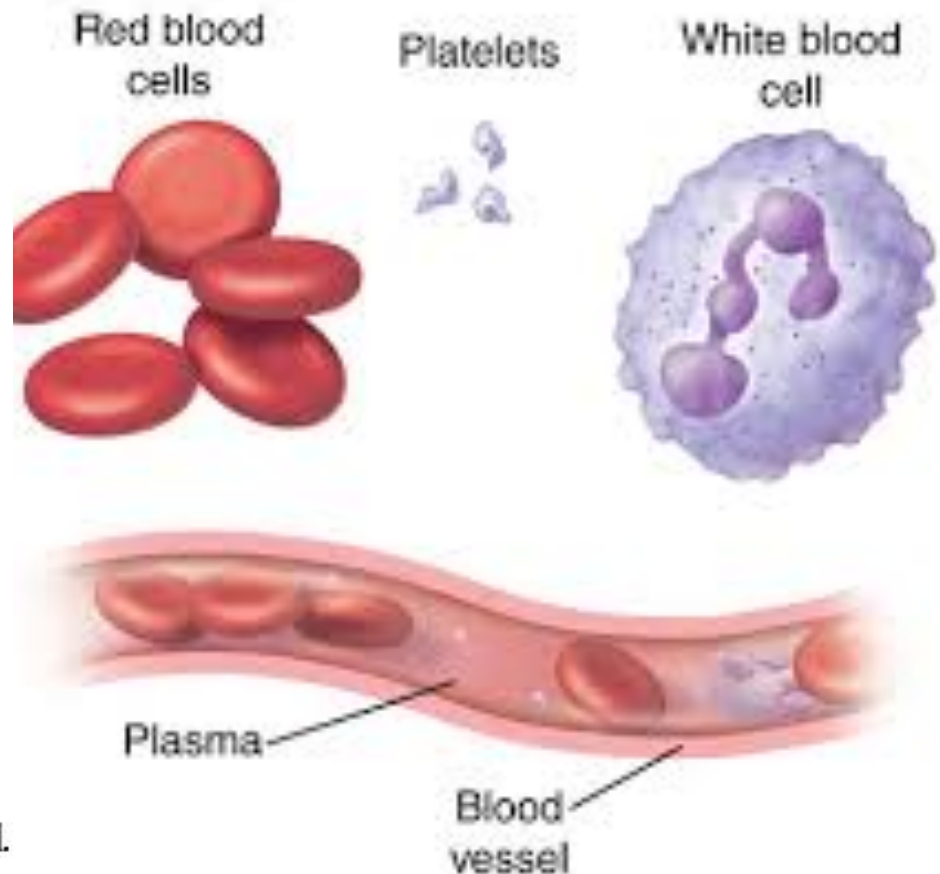
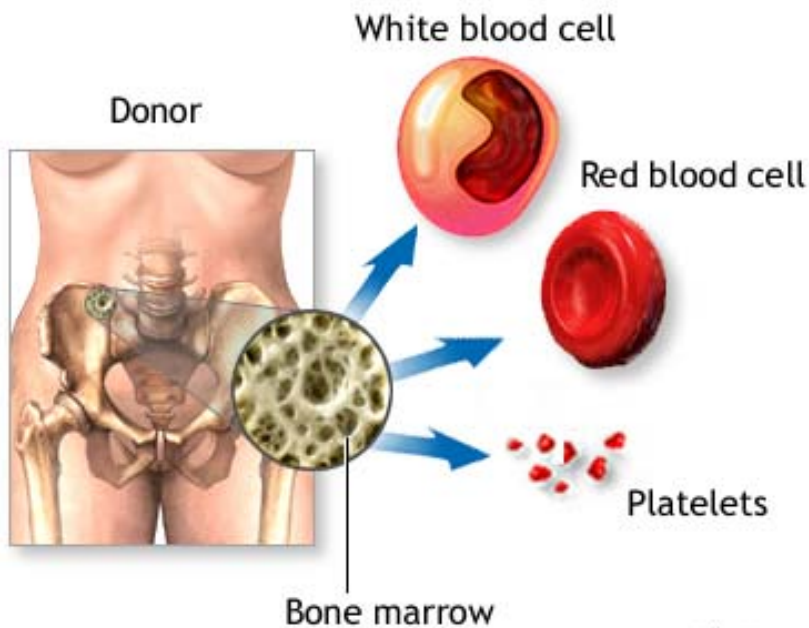


BLOOD COMPOSITION



BLOOD CELLS

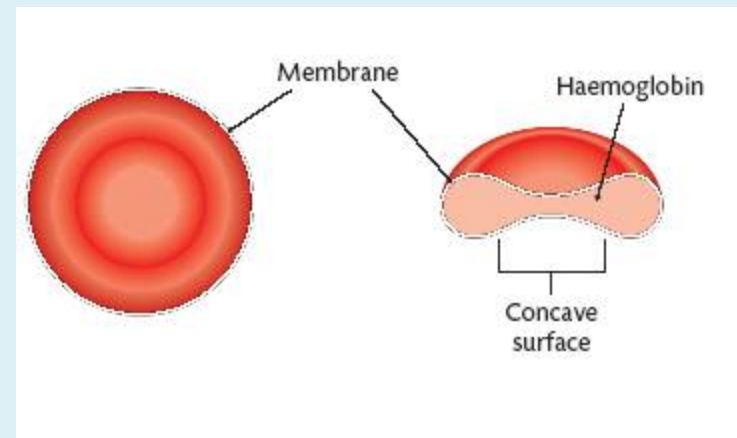
- Three main types of blood cells:
 - Red blood cells:
 - White blood cells:
 - Platelets



RBC

■ Red blood cells:

- No nuclei
- red because they have hemoglobin (protein with contains iron) -
- Made in bone marrow
- Carry oxygen
- Disc-shaped with middle pushed in – this creates a larger surface area to absorb oxygen
- Because they don't have a nuclei → more hemoglobin in cytoplasm and hence absorb more oxygen
- Hemoglobin + oxygen → oxyhemoglobin



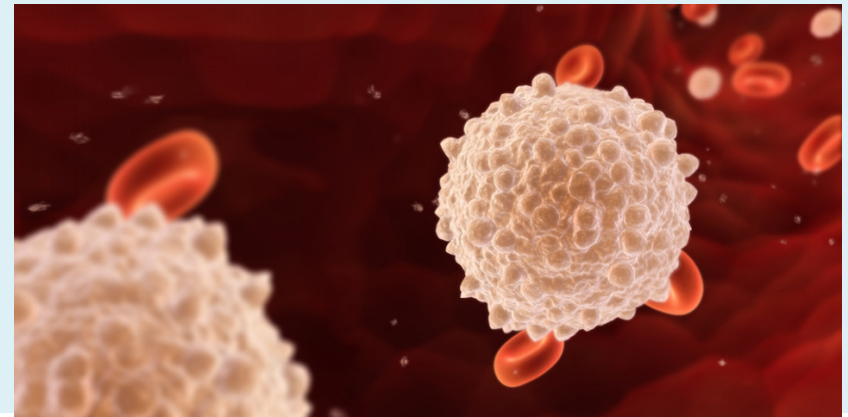
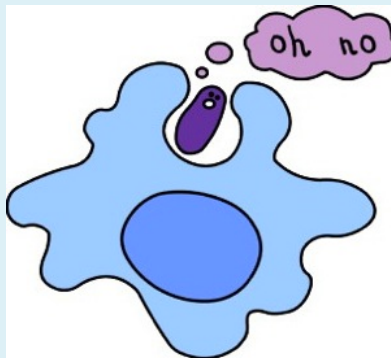
WBC



White Blood Cell

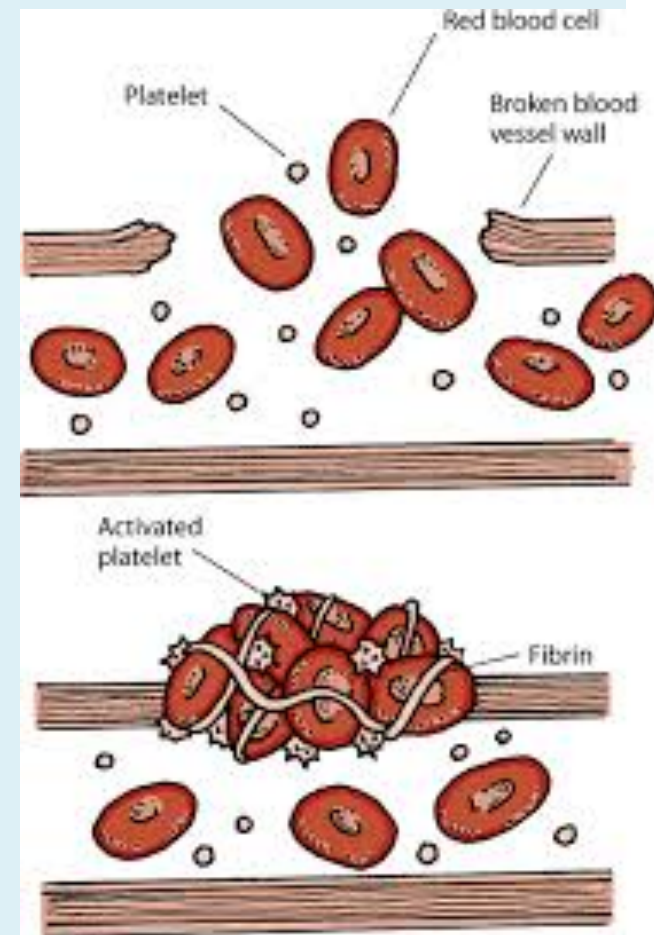
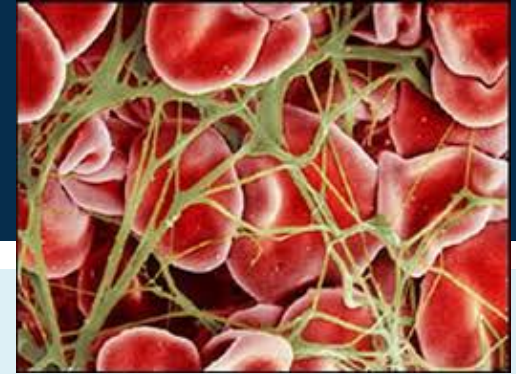
■ White blood cells:

- Defend us against diseases/pathogens
- Much less the RBC
- Have nuclei
- Two types
- Colorless under microscope (white when spun in centrifuge)
- Two types:
 - Phagocytes – ingest pathogens like bacteria
 - Lymphocytes – recognize foreign bodies and makes proteins called antibody



PLATELETS

- They are small fragments of cells
- They are made in the bone marrow
- Cause the blood to clot when vessels are damaged
- Clotting process:
 - Platelets release a substance to change the soluble fibrogen to insoluble protein fibrin
 - This forms a meshwork of fibre
 - RBC get trapped in threads to make the clot
 - Clot hardens to make a scab



TISSUE FLUID

- Substances, like WBC, can escape from the plasma in the gaps of the capillary wall
- This forms the tissue fluid (bath where cells swim in)
- Tissue fluids provides a stable environment helping substances diffuse in and out of cells
- In to cell from tissue fluid: oxygen and glucose
- Out of cell to tissue fluid: Carbon dioxide and waste material like urea
- Tissue fluid passed back to capillaries

